Claims

Claim 1. A flexispline motor comprising a cylindraceous electromagnetic core, a flexispline and rotatable hub means mounted on suitable support means in a working relationship,

said core being provided with a set of suitable windings to produce a commutated and controlled rotating magnetic field,

a flexispline comprising a disc portion and cylindrical portion integrally joined together to form the general shape of an open ended tin can mounted on said support means in such a manner that it encompasses said magnetic core and is in a coaxial relationship with said core,

said cylindrically shaped portion of said flexispline comprising an elastically deformable magnetic material and being in a closely spaced relationship with said core but not touching said core in an unexcited magnetic state,

said flexispline having toothed external gear means formed thereon in the form of an elastically deformable band encircling the exterior surface of said cylinder generally near the open end of said flexispline,

hub means mounted on said support means adjacent to and coaxially with said flexispline, said hub having complementary ring gear means overlying but closely spaced with said gear means on said flexispline,

wherein said open end of said flexispline and said gear means being distorted in the presence of a magnetic field in said core to form a general multilobed shape such that said gear means on said

flexispline exhibits toothed engagement with said ring gear on said hub at the protruding lobes on the distorted shape so formed.

Claim 2. A flexispline motor comprising a cylindraceous electromagnetic core, a flexispline and rotatable hub means mounted on suitable support means in a working relationship,

said core being provided with a set of suitable windings to produce a commutated rotating magnetic field,

a flexispline comprising a disc portion and cylindrical portion integrally joined together to form the general shape of an open ended tin can mounted on said support means in such a manner that it encompasses said electromagnetic core and is in a coaxial relationship with said core,

said cylindrically shaped portion of said flexispline further comprising an elastically deformable magnetically permeable material and being in a closely spaced relationship with said core but not touching said core in an unexcited magnetic state,

said flexispline having an elastically deformable toothed internal gear means formed thereon on the interior surface of said cylinder in the form of a band, near the open end of said flexispline,

hub means mounted on said support means adjacent to and extending coaxially with said flexispline, said hub having complementary toothed gear means formed thereon at one end thereof,

said gear means being encircled by said elastically deformable toothed internal ring gear means of said flexispline,

said gear means and said internal ring gear being in closely spaced relationship, but not touching in an unenergized magnetic state,

wherein said internal ring gear being distorted upon the presence of a magnetic field in said core to assume a multilobed shape and contact said ring gear at the protruding lobes of the multilobed shape so formed.

Claim 3. A flexispline motor as claimed in claim 1 wherein said flexispline is overwound with a magnetically permeable tape or as a helix of a magnetically permeable wire material with locked in radial stress or pressure.

Claim 4. A flexispline motor as claimed in claim 2 wherein said flexispline is overwound with a magnetically permeable tape or as a helix of a magnetic wire material with locked in radial stress or pressure.

Claim 5. A flexispline motor comprising a base, a hollow post affixed to said base, a cylindraceous electromagnetic core and a flexispline mounted on said base and said hollow post so as to enjoy a coaxial working relationship with said hollow post,

said core being provided with a set of suitable windings to produce a commutated and controlled rotating magnetic field,

a flexispline comprising a disc portion and cylindrical portion integrally joined together to form the general shape of an open ended "tin can. mounted on said support means in such a manner that it encompasses said magnetic core and is in a coaxial relationship with said core,

said cylindrically shaped portion of said flexispline comprising an elastically deformable magnetically permeable material and being in

a closely spaced relationship with said core but not touching said core in an unexcited magnetic state,

said flexispline having toothed external gear means formed thereon in the form of an elastically deformable band encircling the exterior surface of said cylinder near the open end of said flexispline,

shaft means mounted within said post means on suitable bearings for rotation within said post and passing through said base, said shaft means being connected to a disc shaped hub at an end opposite said base,

ring gear means carried by said hub in a working relationship with said flexispline,

said ring gear means and flexispline gear means having gear teeth that will mesh, but differ in number,

wherein said open end of said flexispline and said gear means being distorted in the presence of a magnetic field in said core to form a general multilobed shape such that said gear means on said flexispline exhibits toothed engagement with said ring gear on said hub at the protruding lobes on the multilobed shape so formed.

Claim 6. A flexispline motor comprising a base, cylindraceous, electromagnetic core, a hollow post, a flexispline and rotatable hub means mounted on a suitable shaft at a point intermediate its ends,

said shaft means passing within said hollow post and controlled magnetic core and being supported on suitable bearing means,

said shaft means being accessible at both ends of said motor,

said core being provided with a set of suitable windings to produce a rotating magnetic field,

a flexispline comprising a disc portion and cylindrical portion integrally joined together to form the general shape of an open ended tin can mounted on support means in such a manner that it encompasses said electromagnetic core and is in a coaxial relationship with said core,

said cylindrically shaped portion of said flexispline comprising an elastically deformable magnetically permeable material and being in a closely spaced relationship with said core but not touching said core in an unexcited magnetic state,

said flexispline having an elastically deformable toothed internal gear means formed thereon on the interior surface of said cylinder in the form of a band, near the open end of said flexispline,

hub means carrying a ring gear means mounted within said flexispline and extending coaxially with said flexispline, said ring gear means being encircled by said elastically deformable toothed internal ring gear means of said flexispline,

said gear means and said internal ring gear having teeth which will mesh but differ in number and being in closely spaced relationship, but not touching in an unenergized magnetic state,

wherein said internal gear means being distorted upon the presence of a magnetic field in said core to assume an multilobed shape and contact said ring gear at the protruding lobes of the multilobed shape so formed.

Claim 7. A flexispline motor as claimed in claim 5 wherein said flexispline is overwound with a magnetically permeable tape or with a helix of a magnetically permeable wire material with locked in radial pressure or stress.

Claim 8. A flexispline motor as claimed in claim 6 wherein said flexispline is overwound with a magnetically permeable tape or with a helix of a magnetically permeable wire material with locked in radial pressure or stress.

Claim 9. An electromagnetic core for a flexispline comprising a magnetically permeable core of a hub and spoke shaped construction,

said core comprising stacked laminations to form a unitary structure having an even number of radially spaced rectangular profile poles surrounding said hub,

a winding fitted to each pole to produce a magnetic field in each pole, and

the windings on each pair of opposing poles on said hub being energized to produce magnetic fields which oppose each other.

Claim 10. An electromagnetic core as claimed in claim 9 wherein the coils of each pair of opposing poles on said hub are connected in a series relationship.

Claim 11. An electromagnetic core for the production of a continuous wave deflection in a magnetically permeable flexispline member in a flexispline motor comprising,

a series of stacked laminations stacked together to form a unitary core having a hub and spoke configuration, such that an even number of rectangular profile core legs extend radially from said core hub at evenly spaced intervals,

each leg being supplied with suitable coil means,

each coil being sequentially energized from a suitable source of to electrical energy to produce a rotating electrical field in said core,

and wherein the magnetic forces produced in each opposing pair of core legs is in a bucking relationship.

Claim 12. An electromagnetic core as claimed in claim 13 wherein the number of core legs is eight,

and the source of electrical energy is a four phase source having frequency, amplitude, and commutation-control of the output current wave forms,

and the coils on each pair of opposing pairs of core legs is connected to said source of electrical energy in a series bucking relationship.

Claim 13. An electromagnetic core for a flexispline motor said core comprising a circular configuration and having a series of radially extending rectangular profile teeth protruding from said core, said teeth having teeth of variable widths arranged in a regular sequence around the circumference of said core separated by slots of uniform width.

Claim 14. An electromagnetic core for a flexispline motor comprising a stack of magnetically permeable laminations arranged to form a substantially cylindrical core, said core having a series of projecting

rectangular shaped teeth having two distinct widths separated by slots of equal width, and wherein teeth of lesser width are double the number of the teeth of wider width.

Claim 15. A winding system for the electromagnetic core of claim 14 wherein each core tooth of wider width is provided with a first coil and a secondary coil is made to encircle said first coil plus the teeth of lesser width on either side of said core tooth of wider width.

Claim 16. A flexispline motor comprising an electromagnetic core, a flexispline sleeve, and a gear device wherein:

said core is mounted on a stationary member and has the general shape of a cylinder having a splined exterior surface, said core having a set of windings incorporated therein to produce a rotating magnetic field in said core,

a magnetically permeable sleeve mounted coaxially on said core having the shape of a hollow cylinder having an interior cylindraceous surface having a spline formed in said interior surface to mate with said splined exterior surface of said core in a sliding relationship which permits flexing in a radial direction and transfer of torque but which does not permit said sleeve to move in a circumferential direction,

said sleeve having an overlapping end extending beyond said core, said overlapping end of said sleeve having an internal gear formed therein having a predetermined tooth form of constant pitch, a driven gear being mounted within said overlapping end of said sleeve in a coaxial relationship with said core and said sleeve,

wherein said driven gear having teeth which mesh with said internal gear and being mounted to permit rotation about a central axis of

said sleeve and core, said gear and said sleeve being in a non contacting relationship in the absence of a magnetic field in said core,

wherein said sleeve undergoing a cyclical elastic deformation in the presence of a rotating magnetic field in said core to form a multilobed shape such that the internal gear formed in said sleeve contacts said driven gear in the presence of a rotating magnetic field in said core, such that the protruding ends of the multilobed shape so formed by said sleeve and internal gear contact said driven gear, to cause said driven gear to rotate.

Claim 17. A flexispline motor comprising a magnetically permeable flexispline having the general shape of an open tin can, having a predetermined radius r,

said flexispline having a set of gear teeth incorporated in a predetermined surface of said flexispline near the open end of said flexispline,

said flexispline being mounted coaxially within and between a pair of substantially cylindrically extending magnetic core assemblies,

an inner core assembly having a series of salient poles whose number is a multiple of three protruding therefrom so that the pole tips of said inner core assembly lie in the locus of a circle having a radius r1,

an outer core assembly having a series of inwardly extending poles equal in number to the poles on said inner core assembly, such that each pole on said outer core assembly is spaced directly opposite from a pole on said inner core assembly, the pole tips of said outer core assembly lie in the locus of a circle having radius r2 such that

r2 is greater than r is greater than r1 winding means on said cores to establish two rotating fields in space quadrature.

Claim 18. A prime-mover apparatus, for converting supplied electrical energy into rotary mechanical motion of a rotor with respect to a stator, about a drive-axis, wherein the stator comprises an elastically deformable magnetically permeable overwound with similar wire or metallic tape embodying a locked in radial stress or pressure;

an annulus having gear teeth, which form a stator-drive-gear;

the annulus is sufficiently elastic as to be deformable radially, being deformable in the sense that the annulus takes on a lobed configuration, upon appropriate radially-directed forces being applied to the annulus;

the rotor is provided with gear teeth, which form a rotor-drive-gear;

the rotor-drive-gear is a solid structure, not deformable to a lobed configuration;

the rotor-drive-gear is concentric with the stator-drive-gear, and the number SGT of teeth on the stator-drive-gear is different from the number RGT of teeth on the rotor-drive-gear;

the stator-drive-gear and the rotor-drive-gear are so configured that, when the thin-walled annulus of the stator has deformed to the lobed configuration, portions of the stator-drive-gear teeth corresponding to the induced lobes of the annulus move radially into meshing engagement with teeth of the rotor-drive-gear;

the stator includes N electrical coils, located at respective coil-orientations, around the drive-axis; in a manner such as to minimise the length of the magnetic flux flow path.

the coils are so structured, commutated, and arranged that, when energised with electricity, the coils create poles which exert respective radially-directed magnetic forces in a programmed sequential manner.

the arrangement of the apparatus is such that the said radially-directed forces act upon the electrically deformed annulus, and induce the annulus to deform into the lobed configuration;

the apparatus includes a commutator, for receiving the supplied electrical energy, and for switching same to the coils, in a specialized manner thereby energising and de-energising the coils, with the unused engerminus some losses being returned to the energy source.

the apparatus includes a cyclic-operator, for operating the commutator for energising and de-energising the coils sequentially in an optimal rotational pattern, around the drive-axis;

the arrangement of the apparatus is such that operating the commutator in the said rotational pattern is effective to drive the lobed configuration of the elastic stator annulus to rotate around the drive-axis, its speed of rotation being a lobe-rotate-speed LRS rpm;

whereby the rotor-drive-gear is driven to rotate at a speed of LRS * (SGT-RGT) / SGT rpm;

the electromagnetic core teeth on which the stator field winding is applied, embody a rectangular profile in axial planform.

Claim 19. The wire comprising the stator field winding of a flexispline motor is formed of hollow superconducting material.